

CITATION

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ABSTRACT

The purpose of this study is to provide case studies of co-operation between education and industry in the Northern Territory in particular; the study also provides exemplars of co-operation between education and industry in Australia and worldwide. The existence of such co-operation is not surprising as education and industry share many common interests. Industry requires the competently trained students, particularly in science, and these students are the products of the education system at various levels: industry wants them to have positive attitudes and to be hard-working and enthusiastic. Industry has the capacity to help promote these positive outcomes whilst the students are still being educated: in fact, the more that industry helps education at all levels the more positive student attitudes towards industry will be.

The Northern Territory has very small population for its land area (about one sixth the area of the Australian continent) with a population of about 160,000 people. The study indicates that there are a comparatively large number of examples of co-operation between education and industry for such a small population and is optimistic about the future of such co-operation.

Case studies involving co-operation between industry and education in Australia's Northern Territory: the role of the professional organisation

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Introduction

Industry and education may at first sight appear strange bedfellows, yet their mutual co-operation is not really strange as they have many common interests. Industry wants the competently trained students, particularly in science, and these students are the products of the education system at various levels: industry wants them to have positive attitudes and to be hard-working and enthusiastic. As ICI's Chairman put it (Harvey-Jones, 1986):-

"One of the things we need most of all is to succeed in getting our fair share of the brightest and best people into manufacturing - and enthuse them. I am far from pessimistic about this."

Industry can help promote these positive outcomes whilst the students are still being educated: in fact the more that industry helps education at all levels the more positive student attitudes towards industry will be. There are a number of researchers interested in this area, but it is generally under-researched. A myriad of schemes exist to achieve industry/education co-operation, but they tend to be one-off, 'ad hoc' schemes, which are seldom formally evaluated. As far as Australia is concerned, the author has been unable to find any body of research in the area, except an article to indicate that there was school-industry liaison (S-I-L) in Western Australia (O'Loughlin, 1980). O'Loughlin also points out in his abstract that:-

Despite the considerable investments of time and money by both industry and schools in school/industry liaison (S-I-L), this area of education activity has not been the province of educational research

O'Loughlin also lists the main areas in which cooperation usually takes place and thus lays a theoretical basis for further study. The feature of the case studies quoted is the involvement at some stage of a professional body which appears to help by bringing the ideas of the individual educational practitioner to the notice of industry. The professional body acts as a mediator and facilitator and may utilise formal or informal channels to promote the idea. On occasions the idea comes directly from industry, but this seems to be the exception rather than the rule.

There are a tremendous variety of ways in which industry can promote education. A recent UK publication called Goldmine (Brown, 1989), which has been updated regularly since 1985, lists the great variety of services that industry provides for British schools either free or at very low prices (approximately 1200 resources from 200 suppliers). No similar publication exists in Australia and to the author's knowledge if one were to be produced it would only contain a fraction of the resources available in Britain. The reason for this is Australia's much smaller industrial base. There are exceptions, of course and CSIRO, the Australian Mining Industry Council and ICI are very generous providers of resources for Australia. As a further illustration of this difference in size, science teacher's conferences in the two countries can be compared. For example, at the Association for Science Education's annual conference in the UK, a wide variety of companies (100-200) exhibit their products many of which are free or at low cost to the 7000-10,000 science teachers who come to see what is available. Both groups have as a main aim the improvement of science teaching in schools. In Australia at the annual CONASTA conference the same situation arises, but on a much smaller scale. Some 200 - 300 teachers come to these conferences and only a handful of companies stage exhibitions.

National Schemes within Australia.

Within Australia, industry supports science education in different ways dependent on the Australian state and also on the company. Primary industry, especially mining is Australia's

biggest producer and probably science education's biggest supporter. There are major prizes for student's work of all sorts, which are sponsored by big companies usually through teacher's professional associations, offering students very worthwhile prizes. For example, probably the biggest annual event in this field is "Australian Science in Schools Week" (ASSIW), which this year was held from 15-19 October. It is sponsored by two big mining companies, a major petroleum company and three government or semi-government agencies, but organised through the Australian Science Teachers' Association. Member associations in each state are actually responsible for arranging and judging the entries, which involves considerable amounts of time and dedication. A major Australian publisher organises a poster competition and the Federal Department of Employment Education and Training (DEET) with the ABC and the Australian Museum sponsors the Earthworm environmental awards. Again these are managed by the science teachers' associations.

In a slightly different context the Australian Quarantine and Inspection Service (AQIS, 1990), is currently looking for someone to write science curriculum materials that will fit into the curricula of the states and emphasise the importance of quarantine to the nation. The Quarantine service sees community knowledge about the necessity for quarantine procedures as essential in the long term and is thus going to fund research into school curricula to achieve that end.

Industry and Education in the States

Different schemes have evolved in different states, varying with the relative strengths of individual industries. For example in Victoria where manufacturing industry is strong, the author's experience whilst teaching there was that companies were very keen to have students see around their premises and to understand how particular processes worked. For example the author took school parties around the ICI (Yarraville) plant which obtains chlorine from salt by the Castner-Kellner Process and also the manufacture of Aluminium at Point Henry (Geelong) by the Heroult-Hall Process. Both firms were very generous with materials for the students and made the tours as interesting as possible. The author also visited many other factories in the vicinity of Melbourne all of which help to keep one's teaching up to date. In a recent article, Murby (1989) explains how the Victorian State Government involved itself in the business development of education and knowledge transfer, though in view of the recent government and business failures in that state it is not known if the business is still viable.

However, in Western Australia whose main industry is mining, a major preoccupation has been efforts to increase geoscience participation in schools, as the numbers of students completing Year 12 Geology has fallen dramatically in recent years. The mining industry has attempted increase interest for geology through the Ministry of Education and the Department of Geology at Curtin University of Technology, by providing kits for schools, by visits of students and teachers to mining sites, and by organising vacation employment for students (Sappal, 1990). In both the ACT and Western Australia CSIRO have organised schemes to allow Year 11 & 12 students to do up to three months on research projects with CSIRO scientists to see how classroom theory is put into practice: the scheme is said to be a success [WAEN, 22/11/90, p8].

South Australia has a careers programme for schools called "Unlock your Future", sponsored by several organisations including Mitsubishi Motors and the South Australian examinations council (SSABSA). This could well have an input into making information about scientific and technical careers more easily accessible. In New South Wales Toshiba have been assisting Saturday schools with the provision of software for the computers and training for the staff (Toshiba, 1990)

The paper will now give some examples of cooperation between industry and science education in the Northern Territory.

Northern Territory Cooperation.

The Northern Territory has a minute population for its land area (about one sixth the area of

the Australian continent) of about 160,000 people, of whom about 25% are Aborigines. There are two main towns, Alice Springs and Darwin, 1500kms apart at nearly opposite ends of the territory, connected by a good road, but without a rail link. Tarred roads to the neighbouring states of South Australia, Queensland and Western Australia and air travel provide a good basic communications network. Additionally Darwin is a port and some supplies come by sea. There are four projects that are of particular interest in terms of industry cooperating with science educators in the Northern Territory. These are the trans-Australia solar challenge, the CSIRO Science Education Centre and the "Lab-on-legs", the "Science Territory" project and the Channel Island Field Study Centre. Additionally mention will be made of a number of other interesting projects.

The World Solar Challenge

This is a story both of competition and also of co-operation. In this race 36 cars,[NTN 10/11/90, p. 23] using power only from the sun raced 3100 kms across Australia, with the overt aim of finding the car that could complete the course in the shortest time. There were 13 Australian entries, 8 Japanese entries, two cars from USA, and lone entrants from several other countries. This was the second trans-Australia race, the first being in 1987. The race's organiser, business-man Hans Tholstrup has used the race to try to increase the interest in solar energy generally, but has been disappointed by the comparative lack of response in Australia [NTN, 20/11/90, p. 12]. Competitors were major industries, university departments, schools and interested individuals. Each group of competitors had advantages that they could gain from the race, in terms of publicity, improving the technical efficiency of the components, as a problem solving engineering exercise, for the experience, as a motivator for students, as an advertisement or to reap some long term technological advantage. The industrial entrants generally had the highest budgets, the General Motors Sunracer had cost 5 million dollars in 1987 [ST, 21/10/90, p39] and this time, its state of the art gallium arsenide solar panels alone cost \$750,000 (Woodward, 1990). One of the major points of interest was how well the cheaper solar panels would do in comparison. The Northern Territory University entrant, Desert Rose, was placed in fifth position in 1987 [ST, 21/10/90, p39] and was given to a local Junior High School (Dripstone High School) for the 1990 race [ST, 11/11/90, p2]; they made major modifications to it and renamed it Aquila [NTN, 27/10/90, p24]. The Principal Mr R Bucknell pointed out that [ENT, No 3, 1990, p5]:

Preparing the car for its journey would give students many realistic opportunities for practical learning in a number of fields, particularly Maths and Science.

The new Northern Territory University entrant, Desert Rose Mark IX, was sponsored by the NT Government and six local industries. In the end it came 12th and won an Institution of Engineers award [In, 23/11/90, p. 1] after a number of misadventures. The solder between solar cells came apart on a stretch of dirt road [NTN, 14/11/90, p3] and it was flipped by violent winds [NTN, 16/11/90, p2]. The race was won by a Swiss entry with Australian designed solar panels. Dripstone High School's, Aquila was the first school entry to cross the line and also won an Institution of Engineers award [In, 23/11/90, p. 1].

The main point to be made is that the cooperation between industry, Government and education at all levels with the general support of a professional association, the Institution of Engineers, has benefited all concerned, and will undoubtedly lead to technical innovation in the field of solar energy.

The CSIRO Science Education Centre.

This is a local example of a national project sponsored by the huge government backed Commonwealth, Scientific and Industrial Research Organisation. CSIRO has been very supportive of educational endeavours for many years and now has science education centres in all states and territories. The organiser of the centre is an experienced and enthusiastic Darwin teacher, whose salary is still paid by the NT Government. A number of the exhibits are sponsored by individual firms, for example, the bicycle powered dynamometer, presented by the Power and Water Authority (PAWA) [ENT, N04 1989, p7]. The function of these centres is to provide a place where primary school students (or, in some states where primary

students are already catered for, secondary school students) can see and use scientific equipment. It is hoped that this will be a major motivator for school children and may encourage increasing numbers of them to take up science as a career and assist in making Australia the "clever" country.

In the Northern Territory the centre is housed in a former social club, conveniently situated adjacent to CSIRO itself in the northern suburbs of Darwin. It was formally opened by Dr Laurie Corbett of CSIRO on 31 May 1990, though it had been partially open for about a year [ENT, N04, 1989, p7], and the opening ceremony included an address by the local manager of IBM. The centre also acts as a base for the Darwin branch of the Double Helix Club, which, as a national organisation for youngsters interested in science, produces a very good student's science magazine, called "The Helix".

The problem of a permanent exhibition set up in Darwin is that children in other centres do not easily get an opportunity to see it. This difficulty has been overcome through the provision of the "Lab-on-legs", sponsored by IBM which allows suitable exhibits to be sent to more remote areas so that children there may obtain experimental 'hands-on' experience. This is yet another difficulty that has been overcome through industry/education co-operation.

Science Territory

The idea for this project was originated by Brian Robertson, the Principal Education Officer (Science) of the Northern Territory Department of Education and through persistence and with the co-operation of industry, the NT Department of Education and the Science Teachers Association of the Northern Territory (STANT), he has been able to translate the idea into reality. The idea was to popularise the science taught in schools through commercial television (Robertson & Palmer, 1990). Brian believes that television is one of the best media to educate students and thought up the idea of "Science Territory", then called "NT Science Minutes", as a means of improving children's attitudes to science. The programmes are short, snappy, one-minute sequences which link a classroom scene or experiment with a real life situation at home or at work. Brian says (Anon, 1989):-

When these programs catch the interest of students, then the benefits for school-based education will be enormous. Interest level is perhaps the most important factor in determining what a student learns and raising the level of interest in school subjects is what these programs are about.

STANT and the NT Chamber of Mines recognised the worth of the project early on and each put \$500 towards making one example of the sort of film that was planned. The film was made, shown at a wine & cheese evening to possible sponsors. Since then money has been forthcoming to make 24 one minute films and to have them shown on Channel 8 TV about 12 times a week for six months. BHP Petroleum is now the main sponsor, and has provided the bulk of the money for employing a professional company to make the films and for paying for television time. The NT Chamber of Mines and the Science Teachers Association of the Northern Territory provided support early on and local science teachers have been involved in making the films as actors and consultants. The quality of the films has improved with a very lively female commentator, a former student at one of the local high schools, who now introduces all the films. The success of the venture is now assured locally, so soundings are being made as to its possible implementation nationwide or perhaps even internationally.

The Channel Island Field Study Centre.

The Channel Island Field Study Centre is a unique and imaginative venture made possible by a number of unusual circumstances. Firstly Darwin needed a new power station and after considering the options a coal fired power station was decided upon. This needed to be close to a deep water port to unload the fuel, but preferably not too close to Darwin, as it was likely to be rather dirty. One of the possible sites was a small island only 10kms from Darwin as the crow flies, which had formerly been the site for a leprosarium. A bridge was built to the island and the construction of a coal-fired power station started. Whilst it was being built, natural gas in large quantities was discovered in Central Australia 1500kms away. It was decided to change it to be a gas fired power station and to build a gas pipe-line. Darwin now has a modern gas fired electrical power station situated on a small island, which it was then realised, also had a number of other features of considerable educational interest. Channel Island has had an interesting history as a leper colony, now described in "A Suitable Island Site" by Susanne Saunders. The ruins of the settlement still exist amongst the undergrowth and are gradually being cleared so that visitors can appreciate what life was like there. The island's shoreline is protected by a narrow belt of mangroves, containing 14 different species which is a splendid habitat for countless marine animals. This has been made more accessible by the construction of a board-walk which allows school parties and other visitors to appreciate the ecology of the mangrove area without having to wade knee-deep in mud. The geology of the island is also of interest in that reveals the bedrock as layered sediments 2000 million years old, on which Kakadu and the Katherine Gorge now rest. A field centre has now been established at Channel Island with a permanent staff member provided by the NT Department of Education, and the buildings and running costs supplied by the Power and Water Authority (PAW A). This is now a very valuable resource for Darwin schools provided by cooperation between a statutory body and the NT Department of Education.

Other Industry Sponsored Initiatives

The initiatives mentioned above are parts of large projects, but there are a multiplicity of smaller projects some of which are nationally sponsored from which the Northern Territory has benefitted and some of which are entirely local. There awards for teachers, for students and for institutions. Four NT teachers went on the ANSTO Courses (this is the nuclear research institution which gives teachers a week's course and airfares at a nominal charge). One NT teacher was awarded a Shell Fellowship and another a CRA fellowship. The Ranger Uranium mine put on a special display for Australian Science in Schools Week at two local schools. The NT Chamber of Mines, the Institution of Engineers and the Power and Water Authority all gave generous prizes to local students. In the Earthworm Environmental Awards, previously mentioned, the students of one NT primary and one NT secondary school won valuable prizes for their respective schools (Jacob, 1990). Most of these competitions were actually organised by the Science Teachers Association of the Northern Territory (STANT) with the co-operation of the sponsoring body.

Similarly the Royal Australian Chemical Institute has organised a variety of activities through generous sponsors. For example in 1989 Degussa sponsored a mini-conference on the use of hydrogen peroxide in gold mining and funded an annual prize for the best chemistry student at the University. In 1990 Waters Ltd organised a one day seminar on capillary chromatography and provided luncheon for delegates.

Conclusion.

The preceding pages should have given evidence that even in the smallest state (population-wise) in an underpopulated country there is a great deal that can be done and is being done to improve science education. This is being achieved through the cooperation between industry,

education, government, including its agencies and the professional associations, which appear to play a pivotal role in this co-operative process. It is hoped that the information given above will be of use to teachers in the United Kingdom and that some of the ideas for improving student motivation may actually be transferable.

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Resources.

A number of videos are available to illustrate solar cars, Science Territory, some of the Australian Science in Schools Week entries and the Channel Island Field Study Centre.

Minor References

Anonymous or minor articles from newspapers or newsletters may be mentioned in the text, using the following abbreviations:-

Education Northern Territory, [ENT]

Intuition (NTU Staff Newspaper: [In]

Northern Territory News, [NTN]

Sunday Territorian, [ST]

West Australian Education News, [WAEN]